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ABSTRACT

This study examined teachers' perceptions of changes in student learning and changes in their teaching strategies after implementing the Partners Advancing the Learning of Math and Science (PALMS) approach in an urban Massachusetts school district. PALMS was a cooperative statewide systemic initiative funded by the Massachusetts Department of Education and National Science Foundation to implement the state reform measures outlined in the 1993 Educational Reform Act and the Massachusetts Curriculum Framework Teachers Guides. PALMS involved developing higher level critical thinking, cooperative learning, integrated curriculum, thematic units, constructivism, inquiry-based learning, brain-based learning, accelerated learning, multiple intelligences, and learning styles. Data from teacher surveys indicated that the educational benefit for students made the extra time and work involved in teachers utilizing this approach worth their time and effort. Teachers felt PALMS had a positive impact on classroom and school culture and increased teacher and student learning enjoyment. Utilizing PALMS gave teachers time to observe and help students with individual learning needs thereby maximizing their learning potential. Teachers who believed PALMS was good for their students were utilizing it 6 years after initial implementation. (Contains 66 references.) (SM)

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An Integrated Hands-on Inquiry Based Cooperative Learning Approach:

The Impact of the PALMS Approach on Student Growth

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Paper presented at the Annual Meeting of the
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Abstract

This study examined how the change process and educational reform measures utilized in the PALMS approach affected classroom teaching and learning practices in an urban area of Southeastern Massachusetts. Teacher surveys provided data about the Partners Advancing the Learning of Math and Science (PALMS) approach. PALMS was a Cooperative Statewide Systemic Initiative funded by the Massachusetts Department of Education and the National Science Foundation to implement the state reform measures outlined in the 1993 Educational Reform Act and the Massachusetts Curriculum Framework Teachers Guides into routine utilization in teacher's classrooms throughout the state.

The need for looking at innovations in relationship to classroom teaching practices was highlighted in the 1980s by Clark and Peterson (1986), Sarason (1982), and Wittrock (1986). The results of this study build on the previous work of authors who have found that teaching practices could be improved by using effective communication and problem-solving strategies to resolve problems and enhance student learning (Argyris, 1993, Winter; Argyris & Schön, 1978; Calhoun, 1994; Schön, 1987; Slavin, 1989; Stone, 1995). The data from this study indicated that: (a) the educational benefit for students made the extra time and work involved in teachers utilizing this approach worth their time and effort, (b) utilizing the PALMS approach gave teachers time to observe and help students with their individual learning needs in order to maximize the students' learning potential.

The significance of this study lies in the fact that it went beyond the implementation and routine use stage and evaluated the change process after it had already become institutionalized in order to evaluate its effectiveness for improving teaching and learning classroom practices. Educators need to go beyond innovation implementation and become reflective practitioners who continuously conduct ongoing reflective improvement practices (Schön, 1987). The highly educated, critical thinking students of today must be the knowledgeable adults that society depends on tomorrow (Commission on the Skills of the American Workforce, 1990, June; French et al., 1990; National Governors' Association, 1991; Secretary's Commission on Achieving Necessary Skills (SCANS), 1991; Taskforce on Teaching as a Profession for the Carnegie Forum on Education and the Economy, 1986).

Introduction

This study explored teacher perceptions of changes in student learning, as well as changes in their teaching strategies as a result of implementing the Partnerships Advancing the Learning of Math and Science (PALMS) approach. The Project PALMS Initiative was the Cooperative Statewide Systemic Initiative funded by the Massachusetts Department of Education and the National Science Foundation to implement the state reform measures outlined in the 1993 Education Reform Act and the Massachusetts Curriculum Framework Teacher Guides. The PALMS approach of teaching and learning involves developing higher level critical thinking, cooperative learning, an integrated across the curriculum approach and thematic units, constructivism, inquiry-based learning, brain-based learning, accelerated learning, multiple intelligences, and learning styles (Bloom, 1956; Johnson, Johnson & Holubec, 1991; Johnson & Johnson, 1994; Kagan, 1992; Fogarty, 1991; Jacobs, 1997; Brooks & Brooks, 1993, 1999; Marzano, 1992; Jensen, 1995, 1998; Caine & Caine, 1990, October, 1991, 1994; Grassi, 1993; Rose 1985; Rose & Nicholl, 1998, March; Gardner, 1993; Carbo, Dunn & Dunn, 1986; Engle & Arthur, 1994; Dunn & Dunn, 1978; Mc Carthy 1980, 1990). The PALMS approach embraces the educational goals of the Secretary's Commission on Achieving Necessary Skills (SCANS) (1991), Tucker (1992), Taskforce on Teaching as a Profession for the Carnegie Forum on Education and the Economy (1986) and the Commission on the Skills of the American Workforce (1990, June).

Project PALMS: A Statewide Systemic School Change Initiative

The PALMS brochure (1995, June) distributed by the Massachusetts Department of Education simply stated the PALMS approach as "Hands-On, Minds-On Problem-Solving in Today's Classroom." The following PALMS vision statement appearing in the same brochure defines the PALMS approach.

> All ... students will receive a high quality, hands-on education in mathematics and in science and technology that empowers them to be productive, problem-solving citizens and workers. Partnerships among business, institutions of higher education, policy makers, governmental agencies, cultural institutions, teachers and families will create a rich learning environment and provide a lasting foundation for continual improvement. Challenging standards for content, teaching methods and equity defined in statewide curriculum frameworks will guide district practice. Learning will be active, built on discovery and reflection, and a variety of assessments will test for understanding. New

> teachers will enter the profession with a solid grounding in mathematics and science content and in effective strategies for engaging a diversity of learners. Experienced teachers will continually deepen their knowledge and professional skills. PALMS will be the vanguard of education reform. (PALMS, 1995, June, p.1-2)

The Massachusetts Department of Education, through its comprehensive research on what made change successful, co-funded a grant with the National Science Foundation and established the Partnerships Advancing the Learning in Math and Science (PALMS) as the vanguard for implementing education reform throughout the state (PALMS, 1995, June). This initiative has provided teachers with extensive training and ongoing support for the last six years so they could learn the new strategies involved in the PALMS approach and implement this hands-on, inquiry-based, cooperative learning approach into their routine daily teaching and learning classroom practices. This extensive ongoing training initiative involved university and business partnerships actively working with teachers, administrators, policymakers, and parents to implement the curriculum reform measures into classroom teaching and learning practices throughout the state. This collective team worked with challenging content standards based on the Massachusetts Curriculum Frameworks in a rich learning environment that assisted students in creating a lasting foundation based on continuous improvement and lifelong learning that empowered the students to become productive, problem-solving citizens and workers (PALMS, 1995, October, p. 2).

Students with different learning styles, diverse ethnic and economic backgrounds, diverse family structure, as well as physically challenged students all had to be provided a high-quality educational opportunity that allowed them to meet the educational standards necessary to graduate and become successful adults (French, Dunn & Nellhaus, 1990, February; PALMS, 1995).

Advanced class work had to be made available to all students. Every student needed to be given a challenging, adequate education that encouraged lifelong learning, emphasized higher level critical thinking skills, promoted problem-solving strategies and techniques, and satisfactorily met all the state standardized graduation requirements (French et al., 1990, February; Massachusetts Department of Education, 1995, May-a; PALMS, 1994, October, 1995, June, 1995, October). Massachusetts felt it was necessary to utilize this educational approach in classrooms because knowledge has become the adult worker's trademark in our global society,

and ideas have become the required tool necessary for career success (Fiske et al., 1992; Taskforce on Teaching as a Profession for the Carnegie Forum on Education and the Economy, 1986).

Individual workers need to be able to read vast amounts of information, analyze it, and successfully share their understanding of the information with their coworker team members in order to effectively generate new ideas for resolving problems (Fiske & et al., 1992; French et al., 1990, February; PALMS, 1995, October). The PALMS approach helps teachers prepare students to become lifelong learners, critical thinkers, and problems solvers capable of working together. Today's work force needs to be able to adapt to the demands and challenges involved in a global society where complex multiple career and job changes will be a necessary part of their adult lives (Fiske et al., 1992; French et al., 1990, February; Massachusetts Department of Education, 1995, May-a, 1997, April; PALMS, 1993, October, 1994, October, 1995, June, 1995, October; Taskforce on Teaching as a Profession for the Carnegie Forum on Education and the Economy, 1986).

The findings outlined in the report "A Nation Prepared: Teachers for the 21st Century" (Taskforce on Teaching as a Profession for the Carnegie Forum on Education and the Economy, 1986) identified the underlying philosophical foundation of the PALMS approach. This reported emphasized that in order to uphold our present standard of living, our school systems must become learning organizations concentrating on producing an entire workforce of highly educated skilled workers capable of competing globally. The focus of education, according to this report, must shift from producing only a few highly skilled, top-level workers to creating a nation of learners and workers who were all critical thinkers if we wanted to continue being recognized as a world leader. In order to maintain our current leadership position our nation, needed to develop an adult population of smarter, better-educated, highly skilled thinkers capable of utilizing information as the tool of its labor workforce.

Marc Tucker, President of the National Center on Education and Economy, stated that "We must become a nation that thinks for a living" (Fiske et al., 1992, p. 23; Taskforce on Teaching as a Profession for the Carnegie Forum on Education and the Economy, 1986). According to the findings outlined in this report, creating a learning society was crucial to the very survival of our country, since this highly educated, skilled, critical thinking workforce would be the product that produced the capital our country would depend on for existence in the 21st Century. Since both

the Massachusetts Legislature and the Department of Education agreed with the findings of this report the curriculum formulated in the Massachusetts Curriculum Framework Teaching Guides and passed in the Massachusetts Education Reform Act of 1993 implemented these suggestions into the standards being promoted into classroom teaching and learning techniques and strategies through the PALMS approach.

Operational Definitions of the Project PALMS Teaching and Learning Components

PALMS

PALMS is an acronym meaning Partners Advancing the Learning in Math and Science. The PALMS initiative stems from a grant by the National Science Foundation and Massachusetts Department of Education (PALMS, 1993, October, and 1995, June). This philosophical approach involves using hands-on, inquiry based, cooperative learning where small groups of students use real world experiences to hypothesize, problem solve and construct meaning about the world. Processing, sharing and evaluating what they did, why they did it and what they learned with their classmates and teacher is an important part of the learning process. This approach allows students to have a voice in what they would like to learn about a topic. Accessing the students' prior knowledge of the subject area or topic to be studied is the first step in utilizing this curriculum approach. This can be done in the form of a topic web where children brainstorm ideas about the topic graphically around the title of the unit. After the unit of study is completed the students can go back to this topic web, using a different color to add what they have learned during the unit as well as cross out any information that they found to be invalid as they studied to unit. Some teachers also use a K W L Chart that has three columns to show (a) What the Students Know, (b) What the Students Want to Learn, and (c) What the Students Did Learn.

Cooperative Learning

Cooperative Learning (Johnson, 1991 et al.; Kagan, 1992) is an approach where students work in groups to do an activity, lesson or project. This approach requires that students learn the social skills needed for effective group or team work, such as (a) using quiet, soft, spoken voices; (b) looking face to face and sitting knee to knee with the person being communicated with during

a conversation; (c) using active listening, where one person speaks at a time and the others listen; (d) politely taking turns; and (e) valuing everyone's contributions to the project. Students learn that effective team building strategies involve coming together as a group by having a shared purpose. Cooperative learning utilizes definite task roles to carry out the necessary jobs that need performing in order to complete the project. Some of the roles involved are (a) recorder, (b) timekeeper, (c) cheerleader, and (d) noise controller. The roles may be rotated to give everyone a chance to try the different jobs before the project is finished.

Integrated Across the Curriculum Approach and Thematic Units

An Integrated Across the Curriculum approach (Fogarty, 1991, Jacobs, 1997) utilizes a global approach that combines reading, math, science, spelling, social studies and language arts to learn about a specific topic. A large time block is set aside to address all of the curriculum areas during the course of a day, week, or month the topic is being studied instead of breaking down the school curriculum into separate isolated subjects to study. Through reading and learning about the thematic unit topic the students will do lessons, activities and projects, which will involve work in reading, math, science, spelling, social studies and language arts.

Constructivism

Constructivism (Brooks & Brooks, 1993; PALMS, 1994) is an approach where students learn and develop meaning about the world they live in by using hands-on activities, research, and experiments to problem-solve real life situations. The school curriculum is centered around an inquiry problem solving technique that involves the student working in all the curriculum areas to resolve a problem using higher level critical thinking skills. Once the project is completed they communicate their findings to others by explaining what they did, what happened and why. The teacher is a facilitator who assists the students in outlining and planning the unit of study by asking them questions that allows the students to develop insights into what they need to do in terms of constructing their own research and experiments to resolve the issue or problem. The students' meaning of the world is developed through their experiences.

Inquiry-Based Learning

Inquiry Based Learning (Marsono, 1992) is an approach similar to constructivism in that the students are using a problem-solving approach to learn about a topic with the help of their teacher. The teacher assists the students through the learning process as they jointly investigate the topic together. Students are developing meaning through experiments. However, in this approach the inquiry experience may be set up by the teacher or outlined in a textbook or resource book. It does not have to be one that the students constructed themselves based on the problem their are trying to solve. An inquiry approach also does not necessarily involve an integrated across the curriculum approach. It could simply involve a unit of study from only one subject area of the student's curriculum.

Brain-Based Learning

Brain-based learning (Caine & Caine, 1990, October, 1991, 1994; Jensen, 1995, 1998) is an approach that involves many different techniques to provide the student with the conditions, experiences and strategies to induce a state of consciousness in the brain that allows optimal learning to take place. This approach stresses that the classroom should be a place that has a relaxed atmosphere, where there is mutual respect for both the teacher and students. This approach also emphasizes that students need to be supported, and validated as individuals. The students need to feel safe, secure and relaxed within the environment of the classroom. The classroom must be seen as a place where the opinions of all students are valued and respected as worthwhile contributions. A brain-based learning approach utilizes water to stimulate the neurons within the brain to increase information transmission within the brain and sensory receptors. It also uses brain exercises to warm up brain functions as well as relaxed breathing activities to condition the brain for optimal learning. This approach emphasizes the fact that all environmental conditions in the classroom affect learning. Besides the conditions already listed this approach realizes that the classroom lighting, color, temperature and amount of oxygen effect student learning. This approach further realizes the fact that individual differences within the functioning of the student's brain must also be considered as essential factors in learning. The teacher should be aware of the multiple intelligences and learning styles of the students within the classroom in order to provided experiences that will enhance the learning of all the

students within the room. Brain-based learning realizes that both conscious and subconscious learning takes place within the student's brain. Peripheral stimuli within the room affects the students subconscious learning level of the student. Student learning is effected on a conscious level through visual, auditory and kinesthetic experiences. Therefore, learning experiences in a Brain-based learning approach should involve all five senses and support both the left and right hemisphere activities of the brain. The learning experiences should also include all seven multiple intelligences in an integrated across the curriculum approach. Using an integrated curriculum approach is based on that research findings that the brain learns by taking into account the entire experience and forming patterns to develop meaning in terms of conditions that are important for survival. The attention of the brain is driven by emotion, and attention drives learning and memory. The brain only stores useful information that the attentional system within the brain determines is important. This is why learning experiences should be relevant and related to the real world experiences of the students.

Accelerated Learning

Accelerated learning (Grassi, 1996; Rose, 1985, Rose & Nicholl, 1998, March) is an approach that utilizes daily class opening rituals involving brain warm up relaxing activities and visualizations to reduce the stress students come to school with. Grassi (1996) explains that accelerated learning utilizes the following six basic elements of structure to enhance student learning.

1. Identities - new identifies are taken on by the student to circumvent the effect of any learning inhibitors they personally have.
2. Decoding - involves vocabulary building to support optimal learning experiences throughout the course of the unit.
3. Active Concert - is a small dramatization utilizing the new words of this unit in a small skit or play.
4. Passive Concert - a very descriptive story that gives factual information is read aloud to the class while music that has a rhythmic beat of 40 - 60 beats per minute is played in the background. The descriptive language of the story awakens all five senses and stimulates the students' visualization mechanisms in the brain in order to enhance learning by utilizing the brains' long-term memory system.
5. Activations - are lessons and activities that involve the students as active participants learning the relevant information in the unit.
6. Culminating Activities - review and celebrate the learning that has taken place.

Multiple Intelligences

Multiple Intelligences (Gardner, 1993) refers to the seven ways that people learn, know and understand about the world. Gardner believes that educators must give consideration to all the ways individuals excel and display their intelligent behavior. Intelligence, for Gardner, is when a person takes knowledge and appropriately applies it. Gardner believes that each person possesses all seven of the following intelligences, but how they utilize the intelligences varies in degrees from person to person.

1. Verbal - linguistic: ability to use language and words.
2. Logical - Mathematical: capacity for inductive and deductive thinking and reasoning, use of numbers, and recognition of abstract patterns.
3. Visual - Spatial: ability to visualize objects and spatial dimensions, and create internal images and pictures.
4. Body - Kinesthetic: ability to control bodily motion.
5. Musical - Rhythmic: ability to recognize tonal patterns and sounds, and a sensitivity to rhythms and beats.
6. Interpersonal - capacity for person to person communication and relationships.
7. Intrapersonal - inner states of being, elf - reflection.

Educators need to help students develop to their fullest capacity level in each of the seven intelligences by providing multisensory learning experiences within the classroom.

Learning Styles

Learning styles (Carbo, Dunn & Dunn, 1986; Engel & Arthur, 1994; Dunn & Dunn, 1978; Gazzaniga, 1985, 1992; Kolb, 1976, 1984; Mc Carthy, 1980, 1990) refer to the preferred ways individuals learn about and interpret the world through their senses and experiences. The VAK learning style referred to whether a person is a visual, auditory and kinesthetic learner (Engel & Arthur, 1994)

- **Visual learners** learn best by reading or seeing pictures.
- **Auditory learners** learn best by listening.
- **Kinesthetic learners** learn best by touching and doing.

Learning styles also refer to whether a person has right or left brain hemispheric dominance (Gazzaniga, 1985, 1992).

- **Left brain dominance** involves reasoning skills that are logical, sequential, rational, analytic, objective and parts to wholé or step by step segments building up to an understanding of the entire concept.

- **Right brain dominance** involves reasoning skills that are random, intuitive, holistic, synthesized, subjective and wholes to part or global learning.

According to Dunn and Dunn (1978) a person's preferred learning style consisted of either a deductive or inductive reasoning process, that existed within a learning environmental framework that had either an intrapersonal (working alone) or interpersonal (working with others) working style preference.

Kolb's four-category learning style model (1976, 1984) was based on the person's interaction of perception (sensing and feelings) and the processing of information (doing and watching) that resulted in obtaining of knowledge. Understanding whether a person preferred to learn through concrete experience, abstract conceptualization, reflective observation, or active experience helped teachers provide teaching and learning practices to fully maximize the student's learning potential.

Mc Carthy (1980, 1990) used Kolb's Learning Style Inventory (1976) and the theory of left-right hemispheric brain dominance to develop the 4MAT System (Mc Carthy, 1980). This step-by-step diversified thematic unit, across the curriculum lesson format, was designed to improve the performance abilities of every student in the classroom by utilizing whole-brain learning experiences that utilized both sides of the brain to meet the learning needs of each individual student (Mc Carthy, 1980, 1990).

Katherine Briggs and her daughter, Isabel Myers, developed the Myers-Briggs Type Indicator (MBTI) based on Carl Jung's theories of human mental processing (La Torre, 1995, Winter, Meisgeier, Murphy, & Meisgeier, 1989; Myers, 1978; Myers-Briggs & Mc Caulle, 1985). This 16-category personality type indicator provided teachers with another powerful tool to improve the student's performance because it helped the teacher understand the different temperament, perception, and judgment patterns utilized by the student to process learning experiences.

Understanding a student's strengths and weaknesses in terms of the innate personality and the cultural influences that affect the different personality types provided teachers with effective ways to react to and plan learning experiences. The teacher, by providing a diversified approach that incorporated the preferred style for receiving and processing information for all personality types, zeroed in on the learning strengths of all students during a curriculum unit to enhance and maximize the learning potential of each individual student. The teacher, by offering a choice of

performance outcomes to demonstrate learning mastery, enhanced student performance by providing opportunities that allowed all students to communicate and demonstrate their understanding and processing of the information in a form compatible with the way they experienced and interacted with the world (La Torre, 1995, Winter; Meisgeier et al., 1989). Understanding this entire process helped enhance both teacher effectiveness and student learning.

Teachers utilizing learning styles theories to enhance classroom learning and teaching practices needed to understand how student behavior affected the teaching and learning process. An IDEA Model *Test for Observation and Application of Behavior Styles* (Garcea, Klise, & Shapiro, 1987) which broke student behavior into four specific categorical styles (affiliative, expressive, inquisitive, and directive) helped teachers understand why the same classroom lesson and/or activity caused both positive and negative student reactions. This test, which was easy to administer and interpret, provided another tool to help teachers maximize student learning.

Carbo's *Reading Style Inventory* (Carbo, Dunn, & Dunn, 1986), based on Dunn and Dunn's Learning Style Model (1978), pointed out how effective an understanding of learning styles was as a tool for teaching reading. This inventory was a tool for enhancing both student learning and teacher efficacy because it enabled the teacher to match the individual student's learning style with the appropriate reading method (Phonetic, Whole Word, Language Experience, Whole Language, Recorded Book). The teacher, with the help of this inventory, was able to utilize the student's learning strengths in order to increase the student's reading enjoyment, fluency, and comprehension (Carbo, Dunn, & Dunn, 1986).

Teaching strategies such as mind mapping, ideas for adjusting classroom environmental conditions, relaxing strategies that relieved student stress and a broad array of lesson plan systems that applied relevant information from learning style theories to practical teaching and learning applications for teachers to utilize in the classroom for enhancing student learning (Jensen, 1995; Mc Carthy 1990).

The Research Questions

Participants in this study were asked to answer open-ended qualitative questions that corresponded to similar questions on the quantitative data section of the survey. This dual methodology was utilized as a cross-reference technique to verify the reliability and validity of

the participants' survey responses. The questions on the participant's survey fell under the following main categorical research questions:

- What effect did implementing this innovation have on teaching and learning practices in teachers' classrooms?
- What subject(s) and percentage of time on a weekly basis did teachers utilize this approach?
- What were the effects on student growth, classroom management, classroom culture, and the school culture reported by teachers utilizing this innovation?

The Purpose of the Study

The purpose of this study was to analyze how the change process involved in implementing the PALMS approach had affected classroom teaching and learning practices, particularly in areas of "Student Growth," "Classroom Management," "The Classroom Culture," and "The School Culture." Clark and Peterson (1986), Sarason (1982), and Wittrock (1986) first highlighted the need for looking at innovations in relationship to classroom teaching practices in the 1980s. The results of this study also build on the work of Argyris (1993, Winter), Argyris and Schön (1978), Calhoun (1994), Schön (1987), Slavin (1989), and Stone (1995) found that teaching practices could be improved by using effective communication and problem-solving strategies to resolve problems and enhance student learning.

Participants

The participants in this study were 62 K-12 teachers from an urban school district in Massachusetts that was in its sixth year of PALMS utilization. Regular education, bilingual, special education, Title I and preschool teachers volunteered to be in this study. This school system consisted of 22 K–6 elementary and preschool classroom schools, three grade 7 and 8 junior high schools, one grade 9-12 regular high school, and one grade 7–12 alternate school. This system had 771 regular education teachers serving 13,293 students, 148 special education teachers serving 2,437 students, and 61 bilingual teachers serving 757 students which represented a total population of 980 teachers in the system servicing 16,487 students.

Table 1 describes the background characteristics of the teacher participants. Female teachers comprised 91.8% of the study. The majority of the teachers were Caucasian (93.9%), regular education classroom (65.6%) elementary teachers (85%) with a BS or BA degree (66.6%). The

remaining teacher participants were junior high teachers (10%) and high school teachers (5%). The type of class and teacher's position responses further revealed that the teacher participant population also included inclusion classroom teachers (18%), special education classroom teachers (9.8%), bilingual education classroom teachers (4.9%), elementary permanent substitute teachers (4.8%), Title I teachers (1.6%), and teachers who service all types of classrooms (1.6%). The average age of the teacher participants was 47.78 years (SD=8.91), and they had an average of 21.61 years in the education profession (SD=10.5). The participants had taught an average of 21.50 years in Title I (SD=2.12), 19.62 years in regular education (SD=11.77), 16.92 years in special education (SD=7.45), 14.50 years in bilingual education (SD=10.21), and 4.84 years in inclusion (SD=5.95). The average class size of the teacher participants was 19.29 students (SD=4.59), and the average grade level was 3.67 (SD=2.67).

Table 1 here

Method

This study went beyond the implementation and routine use stage and evaluated the change process after it had already become institutionalized in order to evaluate its effectiveness for improving teaching and learning classroom practices. A six-year time frame was utilized before participants reflected on the teaching and learning effects that the PALMS statewide systemic change initiative had on their classrooms. The selection of this time frame was based on the research of Fullan and Stiebebauer (1991), Fullan (1993), and Harvey (1990) that found that it took five years or more for complex change to be implemented. Fullan and Stiegebauer (1991) found that teachers needed to experience an innovation or change before they could develop meaning, an operational understanding or could make a judgment about the worth of the innovation or change.

The participants in this study voluntarily filled out a questionnaire reflecting on the differences in their classroom teaching and learning practices before and after PALMS utilization. Teachers indicated the subject(s) and amount of time on a weekly basics they utilized the PALMS approach in their classroom. Teachers also rated 35 variables based on their classroom teaching and learning practices before and after PALMS utilization in the areas of

"Student Growth," "Classroom Management and Teaching Resources," "Classroom and School Culture," and "Concluding Remarks," using a five-point Likert scale where one was the lowest and five the highest. The quantitative responses were examined using the SPSS software package to determine the frequency distribution, mean, standard deviation, and percentile ranking. Paired-samples t-tests and ANOVAs were run.

The participant responses to the open-ended question, "How has utilizing the PALMS approach involving an integrated hands-on inquiry-based cooperative learning approach changed your teaching?" were analyzed by categorizing common themes and patterns identified from the data.

Results

Utilization of PALMS by Subject Areas

Table 2 shows the percentage of time that teachers utilized the PALMS approach for each subject area. The data indicated that science was the subject area in which participating teachers utilized the PALMS approach the most, while social studies was the subject area with the least PALMS utilization. Teachers indicated using PALMS 28.0% weekly in science (SD=29.19) and 25.62% in math (SD=26.37). Teachers utilized an integrated, across-the-curriculum PALMS approach 19.82% of the week (SD=29.76). The time spent utilizing PALMS dropped down to 14.59% of the time on a weekly basis in reading (SD=24.08), and it was used only 13.88% of the time in social studies (SD=22.73).

Table 2 here

Table 3 provides the results of the ANOVAs for the number of years teaching by use of PALMS in the integrated curriculum. Eleven teachers from the 11-20 years in teaching bracket had the highest utilization rate of PALMS (49.09%, SD=46.57) weekly in an integrated curriculum ($F=6.02$, $p=.001$). Ten teachers with 31-40 years in teaching had the lowest utilization rate of PALMS (5.50%, SD=11.60) weekly in an integrated curriculum. The second highest group utilizing PALMS was comprised of 22 teachers with 21- 30 years in the teaching profession. They utilized PALMS (17.73%, SD=21.97) in an integrated curriculum on a weekly

basis. This was less than the 49.09% utilization by the 11-20 year teachers. Teachers with 1-10 years in teaching utilized PALMS (10.42%, SD=15.44) weekly in an integrated curriculum, which was the next to lowest.

Table 3 here

How Teaching and Learning Changed as a Result of Utilizing PALMS

The data indicated that the educational benefits for students made the extra work involved in teachers utilizing this approach worth their time and effort. Utilizing this approach gave teachers time to observe and help students with their individual learning needs in order to maximize the students' learning potential. Teachers indicated that they improved their teaching practices in the areas of student growth, classroom management and resource utilization, classroom and school culture, as well as their ability to help students develop to their fullest potential, even in inclusive classroom settings that contained both regular and special education students.

The paired-samples t-tests for "Student Growth" in Table 4 showed a significant increase ($p \leq .001$) in each teaching and learning variable as a result of utilizing PALMS. Significant increases were found for student time on task ($t = 10.95$, $p \leq .001$), student interest ($t = 15.96$, $p \leq .001$) student motivation ($t = 14.34$, $p \leq .001$), student self-esteem ($t = 4.38$, $p \leq .001$), student learning ($t = 9.43$, $p \leq .001$), student participation ($t = 14.17$, $p \leq .001$), student verbal communication ($t = 10.10$, $p \leq .001$), student written responses to essays ($t = 6.07$, $p \leq .001$), student problem solving ability ($t = 10.66$, $p \leq .001$), student utilization of higher level critical thinking skills ($t = 9.67$, $p \leq .001$), student test scores ($t = 6.91$, $p \leq .001$), student appropriate behavior ($t = 4.67$, $p \leq .001$), student ability to work together ($t = 7.09$, $p \leq .001$), student ability to relate to others and respect each other's individual contributions to the group's project ($t = 8.42$, $p \leq .001$), student ability to evaluate their own work ($t = 8.42$, $p \leq .001$), and positive student attitude toward lifelong learning ($t = 8.69$, $p \leq .001$).

Table 4 here

The paired-samples t-tests for "Classroom Management and Teaching Resources" in Table 5 showed significant increases in the teachers' ability to meet the individual learning needs of every student to develop to their fullest potential ($t = 6.22$, $p \leq .001$), actual teaching time ($t = 4.50$, $p \leq .001$), time to remediate individual students' special learning disabilities ($t = 5.09$, $p \leq .001$), time to remediate students who needed extra help with certain concepts, tasks or skills ($t = 5.51$, $p \leq .001$), teacher planning time ($t = 4.41$, $p \leq .001$), time to organize and assemble teaching materials ($t = 5.43$, $p \leq .001$), classroom use of manipulatives ($t = 10.47$, $p \leq .001$), classroom use of trade books ($t = 6.21$, $p \leq .001$), classroom use of reference resources ($t = 6.57$, $p \leq .001$), classroom use of office supplies ($t = 3.22$, $p = .002$), and classroom use of art, craft and science materials ($t = 8.84$, $p \leq .001$). Significant differences were not found for classroom use of textbooks ($t = -1.88$, $p = .066$). This result is consistent with the fact that the PALMS approach stresses utilizing primary sources and real world experiences.

Table 5 here

The paired-samples t-tests for questions about "Classroom Culture," "School Culture" and "Concluding Remarks" in Table 6 showed significant increases in the areas of teachers' stress level ($t = 2.27$, $p = .028$), positive classroom environment ($t = 3.14$, $p = .003$), staff morale ($t = 3.74$, $p \leq .001$), student morale ($t = 6.62$, $p \leq .001$), students' ability to develop to their fullest learning potential ($t = 9.90$, $p \leq .001$) and the effectiveness of teaching techniques in an inclusive classroom ($t = 9.29$, $p \leq .001$).

Table 6 here

Table 7 shows a significant difference in the results of the ANOVAs for School Level by perceived change in classroom teaching and learning components from the summed difference of the after PALMS use scores minus the before scores. The two junior high respondents averaged the highest change in teaching and learning components, while the three teachers at the high school had the lowest ($F = 4.12$, $p = .023$). The average change of the two junior high teachers

was 36.50 (SD = 12.02), while the average change for the three high school teachers was 6.67 (SD = 9.07), and the average change for the 45 elementary teachers was 28.80 (SD = 13.87).

Table 7 here

Table 8 provides the results of the ANOVAs for class type by perceived change in classroom teaching and learning components from the summed difference of the after PALMS use scores minus the before scores. While no significant difference was found, the 3 bilingual education classroom teachers averaged the highest change in teaching and learning components, while the 9 inclusion teachers averaged the lowest change ($F = 2.40$, $p = .079$). The 3 bilingual teachers' average change was 49.67 (SD 10.02), while the average of the 9 inclusion teachers' change was 26.11 (16.15). The 4 special education teachers had an average change of 27.25 (SD = 7.63), which was similar to the 27.00 (14.51) average change results of the 35 regular education teachers.

Table 8 here

Table 9 shows the results of the ANOVAs for years in teaching by perceived change in classroom teaching and learning components from the summed difference of the after PALMS use scores minus the before scores. While no significant differences were found, the highest change was in the bracket of 11 - 20 years of teaching, while the lowest change was in the 31 - 40 years of teaching bracket ($F = 1.78$, $p = .165$). The 8 teachers in the 11 - 20 years in teaching bracket change average was 37.63 (SD = 12.43), while the 10 teachers in the 31 - 40 years in teaching bracket had an average change of 21.70 (SD = 14.34). The 22 teachers in the 21 - 30 years in teaching bracket had an average change of 29.05 (SD = 11.09), and the 11 teachers in the 1 - 10 years in teaching bracket had an average change of 27.18 (SD = 21.61).

Table 9 here

Table 10 provides the results of the ANOVAs for age by perceived change in classroom teaching and learning components from the summed difference of the after PALMS use scores minus the before scores. The 8 teachers in the 28 - 40 age bracket had the highest change average, while the 20 teachers in the 51 - 65 age bracket had the lowest change average ($F = .67$, $p = .517$). The change average for the 8 teachers in the 28 - 40 age bracket was 34.14 (SD = 19.29), while the change average for the 20 teachers in the 51 - 65 age bracket was 26.40 (SD = 12.42). The 14 teachers in the 41 - 49 age bracket had a change average of 28.36 (SD = 18.40). No significant difference was sound the data revealed that teachers at every age level perceived that there had been a change in their classroom teaching and learning components by utilizing the PALMS approach.

Table 10 here

The open-ended question to which participants responded was "How has utilizing the PALMS approach involving an integrated, hands-on, inquiry-based cooperative learning approach changed your teaching?" The teaching and learning changes cited by the participants resulting from utilizing the PALMS approach mentioned in the qualitative response data fell under six major categories. Table 11 reveals that teachers believed the PALMS approach (a) improved teaching practices by stressing reflective teaching - 23 responses; (b) was good for students - 18 responses; (c) changed teaching methods - 13 responses; (d) increased stress - 3 responses; (e) increased preparation, teaching, and remediation time - 2 responses; and (f) increased the use of teaching materials - 1 response. Five responses mentioned that teaching had remained the same, and no change had taken place in the way the teachers presented their lessons.

The 23 responses under "Improved Teaching Practices and Reflective Teaching," revealed the following teaching changes:

- It made teachers look at their teaching methods to see if they should be changed to help the students. It helped teachers vary their teaching methods to accommodate student learning styles. It provided more time for teachers to observe students and become involved with the class.
- It improved teaching. Without PALMS training, implementing the curriculum frameworks would have been even more difficult.

- Utilizing PALMS made teachers more creative. It made teaching more fun. It validated, enhanced, and expanded teaching practices.
- Cooperative learning increased student teamwork.
- PALMS made teachers more comfortable teaching science, doing experiments and hands-on activities.

Under "Approach Good for Students," the 18 responses cited the following changes in teaching practices:

- Lessons became more interesting, enjoyable, and students loved what they were learning. The PALMS lessons helped students understand the material better. The lessons appealed to all the different learning styles, especially kinesthetic and tactile learners. PALMS caused the students to have a greater interest in the subject area and sparked the teacher's enthusiasm.
- PALMS allowed teachers to take each student from the point of their current understanding to a higher level of understanding and learning because the students could visualize the concept of the lesson. Students contributed their thoughts freely, and they stated their likes, dislikes, and problems in understanding. Students constructed their own meaning from the various methods and techniques used and explained what they had learned. Students were more involved. Lessons became student-centered instead of teacher-centered. This approach allowed more participation among students on all levels.
- PALMS provided the teachers with more time to help children with their individual needs. Some students progress at various rates. This approach included most students and worked well in science and math. The teachers were able to spend less time giving direct instruction and more time observing students and providing immediate feedback as to whether or not a concept was understood. However, teachers believed that reading must be still taught through learning and understanding the relationship between sounds and letters.
- Teachers became aware of the students' need to collaborate through the PALMS approach.

Under "Changed Teaching Methods," 13 responses mentioned that the following changes had occurred:

- Teachers went from total pencil-and-paper tasks to more hands-on, inquiry-based cooperative learning. Teachers now utilized cooperative groups for subjects other than science. Cooperative learning really changed the teachers' teaching approach. Some teachers utilized hands-on, inquiry-based cooperative learning for science and social studies, with a peer group approach in math and reading. Cooperative learning utilizes a highly structured student-assigned role task-oriented project approach, while a peer group approach just has students working together for drill and practice.
- The PALMS approach caused teachers to implement more cross-curriculum lessons and become less traditional in their teaching methods. Teachers constructed lessons

around themes like they did in the 70s, rather than isolated subject areas. However, PALMS added cooperative group projects and hands-on learning to the thematic unit teaching approach.

- Teachers took "Math Their Way" (a manipulative-based math approach) and "AIMS" (an activities integrating math and science approach) training workshops.
- Some teachers tried cooperative learning but did not continue using it.

Five teachers stated the following reasons why "No Change" had taken place in their teaching practices.

- This was because they had always used an-inquiry based, hands-on approach. They had always related subject content to familiar concepts. The type of course had always been hands-on.

Three comments under the category, "Increased Stress" disclosed:

- Teachers felt guilty for not utilizing the PALMS approach more.
- Teachers felt an increase in their stress level because the pace had become too fast for the age level of the students.

The following two responses fell under the category, "Increased Preparation Time / Teaching / Remediation Time."

- Teachers stated that it took hours longer to prepare lessons and gather materials.
- The PALMS approach was more work, but more fun. It was an evolutionary process.

Under "Increased Use of Teaching Materials," one response revealed that:

- A lack of science materials necessitated borrowing them from other teachers.

Table 11 here

Teacher and Student Satisfaction with PALMS

Table 12 shows that the teachers' (N = 48) rating on the overall effectiveness of the PALMS approach was 3.92 on a 5-point scale (SD = .71). The teacher's (N = 49) rating describing how their students liked the PALMS approach was 4.20 (SD = .82) on a 5-point scale. These results corresponded with the teacher participants' satisfaction with their PALMS training based on 49 responses, which was 3.98 on a 5-point scale (SD = .72).

Table 12 here

Table 13 shows the correlation of the effectiveness rating of PALMS with the percent of utilization by subject area. The areas of science, math, and an integrated, across the-curriculum-approach disclosed that a significant positive correlation existed between the teacher's perception that the approach was effective in these subject areas and the utilization of PALMS in these three subjects.

Table 13 here

Table 14 provides the results of ANOVAs for the effectiveness ranking of the PALMS approach by teaching level, based on a 5-point scale. Forty-one elementary teachers rated the overall effectiveness of PALMS at 3.85 (SD=.65), 3 junior high teachers rated the effectiveness at 5.00 (SD=.00), and 2 high school teachers rated the effectiveness at 3.00 (SD=.00). The junior high teachers, though few in number, rated PALMS the highest, while the high school teachers, also few in number, rated it the lowest ($F=6.70$, $p=.003$). The data shows that teachers at every teaching level felt PALMS was an effective teaching approach.

Table 14 here

Table 15 shows that there was no significant difference in rating of the overall effectiveness of PALMS by class type. Whether or not teachers liked the PALMS approach had nothing to do with their teaching position being in regular education, special education, inclusion, or a specialist servicing all classrooms. The data indicates that teachers feel that PALMS is an effective teaching approach in all the various types of classrooms.

Table 15 here

Table 16 shows how teachers perceived that students liked PALMS by teaching levels, based on a 5-point scale. Teachers reported that the students at elementary, junior high, and high school enjoyed using the PALMS approach for learning. Forty-one elementary teachers ranked the average student enjoyment of this learning approach at 4.24 (SD=.66), 4 junior high teachers rated the average student enjoyment at 4.00 (SD=2.00), and 2 high school teachers rated the average student enjoyment at 3.50 (SD=.71). There was no significant difference between the three levels (F=.89, p=.42). Teachers indicated that their students at every level of teaching enjoyed utilizing the PALMS approach for learning.

Table 16 here

Table 17 indicates how students liked the PALMS approach by type of class, based on a 5-point scale. There was no significant difference in the students' enjoyment of PALMS, based on their type of classroom (F=.41, p = .81). Thirty-three regular education classroom teachers rated the average class enjoyment of PALMS at 4.18 (SD=.92), 4 special education teachers rated the average class enjoyment at 4.50 (SD=.58), 7 inclusion teachers rated the average enjoyment at 4.14 (SD=.69), 3 bilingual teachers rated the average enjoyment of PALMS at 4.00 (SD=.00), and one teacher who services all types of classrooms rated the average student enjoyment at 5.00. These data affirm that teachers perceived that students in each of the classroom types enjoyed learning through the PALMS approach at an above-average rating or better. These data are also similar to the effectiveness rating of the PALMS approach by Type of Classroom (see Table 15).

Table 17 here

Discussion

This research agrees with the findings of Rosenblum and Louis (1981) that the worth of innovations needed to be evaluated in terms of what was actually achieved, to what extent, and

whether or not the innovation was successful in terms of student outcomes. Many states are moving to an integrated, hands-on, inquiry-based, cooperative learning, standards-based curriculum format similar to the PALMS approach implemented in Massachusetts in 1993. Like Schön (1987), this study found that the reflective aspect of the PALMS Systemic Change Initiative improved the practice of teaching and teachers reported the approach was good for students.

Factors Influencing Teacher Utilization

The results of this research confirmed Fullan and Stiegebauer's (1991) findings that a positive balance must exist between need, clarity, the personal commitment cost, and the outcome benefits before teachers will utilize an innovation or adopt the mandated change. Evans (1993, September), Fiske, Reed and Sautter (1992), Schlechty, (1993, Fall), Sizer (1984), and The Network (1988), like this research, found that when teachers believed that the approach was worthwhile for student learning, they supported the change initiative. The quantitative data revealed that teachers believed the approach took more time planning, increased the amount of materials, resources and time needed to conduct lessons, but it had significant positive learning outcomes in all the listed areas affecting student growth. This agrees with Fullan's (1982) findings that teachers judge the worth of the change/innovation on the need for the innovation, student interest, the teacher's clarity of understanding about what they need to do, the ease of implementation in terms of time and energy, if it requires the teacher to learn a new skill, teacher excitement, teacher competence, and how the innovation interferes with the teachers' existing priorities. The teacher participants in this study reported utilizing the PALMS approach allowed them more time to observe and help students with their individual learning needs in order to maximize their students' ability to develop to their fullest learning potential.

This study found that teachers who believed that the approach was good for their students were still utilizing the PALMS approach six years after initial implementation. This agrees with Fullan's (1982) finding that lasting change was a result of the teachers' belief that the change was worthwhile. The quantitative data rating the before and after effects of utilizing PALMS revealed that using the PALMS hands-on, inquiry-based cooperative learning approach took more time. It increased both the planning time and the amount of time needed to conduct class

lessons. However, in spite of this, teachers perceived that students benefited from the approach. The quantitative and qualitative data revealed the increased time factor as well as the positive learning outcome results of utilizing the PALMS approach.

Mahler (1996, December) found that the predictor of successful change implementation was when "the perceived positive consequences of the change outweighed the perceived negative consequences of the change" (p. 112). However, Mahler warned "there may be a lag between the rational recognition of positive consequences and the emotional acceptance of the change" (1996, December, p. 112). This is another reason why it was important to wait to do research until the innovation had been fully institutionalized, which meant that it had gone beyond merely being implemented and routinely utilized. The school system and state standards had both outlined utilizing the strategies involved in the PALMS approach and provided implementation training and support in order to ensure that this approach became part of the standard operating procedures of this system, as well as all the school systems in Massachusetts. The teachers in this study had had sufficient time to make the innovation part of their routine daily teaching practice for several years after full implementation had been achieved. This operational procedure agreed with the findings of Crandall and Loucks' (1983) implementation research.

How PALMS Effected School Culture

This study examined the effects the PALMS approach had on school culture based on prior research findings in the area of organizational change. Hersey and Blanchard (1988), Mahler (1996), and Tracey (1993) indicated that successful change in organizational performance involved cultural change. Patterson, Purkey and Parker (1986) and Mahler (1996) explained that lasting change involved understanding and altering the culture of schools. Schein (1985) and Mahler (1996) found that when change resulted from coalitions or power hierarchies, it often had little effect on changing the organization's culture. Since the PALMS approach was being initiated through a state level grant to implement the 1993 Education Reform Act, this study evaluated the effect it had on school culture.

The teachers in this study acknowledged that using the PALMS approach had a positive influence on both the classroom and school culture. Teachers stated that this approach increased both teacher and student learning enjoyment. Teachers reported that using the approach had a

positive influence on the students' ability to develop to their fullest learning potential and provided effective teaching strategies for inclusion classrooms containing both regular and special education students. Teachers acknowledged that the benefits in terms of student enjoyment and learning outcomes outweighed the initial stress that the teachers felt during the implementation stage. Teachers reported that the PALMS approach challenged students, promoted and developed problem solving strategies and critical thinking, activated higher level thinking skills, was fun, was motivating, and students and teachers both enjoyed learning with this approach.

Like the research findings of Mahler (1996) and Patton (1997), the problem-solving strategy of PALMS utilized the school as an organization which operated as an integrated whole that involved both the adopters and the outside consultants working together to analyze the problems, share information, generate solutions, train the teacher implementers, and evaluate the results. The school culture under the PALMS approach created a learning organization that was established by the collaboration of teachers, administrators, and researchers all working together. This strategy created a supportive cultural atmosphere that was non-threatening and conducive to change. This study found that both the staff and student morale significantly improved after teachers implemented the PALMS approach. The data revealed that this congenial, pleasant, enjoyable, positive cultural atmosphere created a school and classroom environment that allowed students to develop a positive attitude toward lifelong learning, increased the student's ability to work with and positively relate to others, enhanced the student's ability to develop to their fullest learning potential and to self evaluate their own work. The idea that school change involved teacher ownership and teacher collaboration with each other, researchers, administrators, and even students in order to change and improve the teaching and learning process has been well documented in recent change literature (Argyris, 1993, Winter, Argyris & Schön, 1978, Calhoun, 1994, Fullan, 1993; Schlecthy, 1993; Senge, 1990, Sizer).

Research Limitations

This study was limited to participants in one urban area of Southeastern Massachusetts, even though PALMS was a statewide initiative. Therefore, the ability to generalize the findings beyond this area may require replication of this study. The population within this urban area was further limited to participants who chose to be included in the study by returning the survey. The

fact that the people who utilize the approach tend to return the surveys more than people who do not also limits the findings of this research. Therefore, there was an unknown degree of bias that resulted based on the non-response element involved with utilizing surveys as the source of data collection (Fink, 1995a, Fink, 1995b). The fact that the approach was mandated on a K-12 level, but a larger proportion of surveys were returned on the elementary level is another factor that must be considered as limiting the results of this research.

Conclusions

This study, like the research of Mahler (1996) and Fullan and Stiegebauer (1991) found that in order for implementation to be successful and utilization to be long lasting the benefits of using the approach must outweigh the teacher's personal commitment cost. The data in this study revealed that teachers had to see for themselves through actual utilization activities the outcome benefits that classroom use of this approach had for their students. The data further revealed that teachers perceived utilizing the PALMS approach was enjoyable, had significant teaching and learning outcomes and was an effective approach for all types of classrooms in grades K-12. The data also showed that teachers of all ages and with various levels of professional experience reported PALMS was an effective teaching and learning classroom approach. Therefore, this study found that the demographic background of teachers was not a factor in PALMS classroom utilization. The data from this study also indicated that teachers found that utilizing PALMS was beneficial both as an integrated across the curriculum approach and as an approach that could be utilized in teaching separate subject areas.

The data revealed that the PALMS approach had a significant positive impact involving all areas of student growth. The paired samples t-tests for student growth before and after PALMS utilization indicated that the teachers responses revealed significant gains in (a) student time on task, (b) student interest, (c) student motivation, (d) student self esteem, (e) student learning, (f) student participation, (g) student verbal communication, (h) student written responses to essay questions, (i) student problem solving ability, (j) student utilization of higher level critical thinking skills, (k) student test scores, (l) student appropriate behavior, (m) student ability to work together, (n) student ability to relate to others and respect each other's individual contributions to the group's project, (o) student ability to self-evaluate their own work, and (p) positive student attitude toward lifelong learning.

The classroom management data revealed that utilizing the PALMS approach gave teachers more time to observe and help students with their individual learning needs in order to maximize their students' ability to develop to their fullest learning potential. This significant student learning benefit outweighed the teachers' personal commitment cost factors. The data indicated that the approach increased the teachers planning time plus the amount of time, materials and resources they needed to conduct lessons.

Yet, in spite of the increased time, material and resource cost factors six years after initial implementation teachers were still utilizing the PALMS approach which involved an integrated hands-on, inquiry based, cooperative learning approach because they believed that the approach was good for their students. The PALMS approach was considered to be a worthwhile systemic change in classroom teaching and learning practices because teachers perceived it to have significant outcome benefits on student growth and achievement.

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Appendix Data Forms

RESEARCH METHODOLOGY SURVEY

Teaching Components Evaluation by Approach Utilization

Please Return to:
June L. Fuller

Thank you.

Dear Colleague,

The voices of educators need to be heard for effective realistic educational reform. Please take a few minutes to fill out this survey.

Thank you.
June L. Fuller

Name_____ (Optional) Gender ____ Ethnicity_____ Year Born ____

** Please sign the informed consent form even if you have selected not to fill in your name here.

The Fielding Institute requires a signed consent form from every research participant. The last page may be detached and returned separately if you so desire. Check this box to show you have signed and returned the consent form separately. ☐ **

School System_____ School_____ Grade ___ Class Size___

Type of Class: Regular Ed. ___Special Ed.___ Inclusion ___Bilingual Ed.___

Position _____ Number of Years in Education Profession ___Degree Level __

Please indicate how many years you have spent in each position: Teaching ____

Reg. Ed. ____ Special Ed. ____ Inclusion Setting ____ Bilingual Ed. _____

- Are you currently using the PALMS integrated hands-on inquiry based cooperative learning approach in your classroom? YES___ NO___

  If yes, please rate the overall effectiveness of the PALMS approach.

  NOT VERY EFFECTIVE HIGHLY EFFECTIVE
  1 2 3 4 5

  If yes, please rate how your students like using this approach.

  STUDENTS HATE IT STUDENTS LOVE IT
  1 2 3 4 5

  If no, are you planning to use the PALMS approach in your classroom? YES __NO__
  If no, why not?

- How has utilizing the PALMS approach involving an integrated hands-on inquiry based cooperative learning approach changed your teaching?

- Please place an X beside the subject(s) in which you utilize this approach and indicate the percentage of time on a weekly basis that you utilize this approach.

_____ Reading	_____% Weekly
_____ Math	_____% Weekly
_____ Social Studies	_____% Weekly
_____ Science	_____% Weekly
_____ Integrated Across the Curriculum Approach	_____% Weekly

How has utilizing the PALMS approach involving an integrated hands-on inquiry based cooperative learning approach changed your teaching? Please respond to the following questions comparing the approach you used before your PALMS training to your approach since utilizing PALMS

Using the following code, please rate each:

LOW 1	BELOW AVERAGE 2	AVERAGE 3	ABOVE AVERAGE 4	HIGH 5

STUDENT GROWTH	BEFORE PALMS	AFTER PALMS
Sample: Student time on task	3	5
1. Student time on task		
2. Student interest		
3. Student motivation		
4. Student self esteem		
5. Student learning		
6. Student participation		
7. Student verbal communication skills		
8. Student written responses to essay questions		
9. Student problem solving ability		
10. Student utilization of higher level critical thinking skills		
11. Student test scores		
12. Student appropriate behavior		
13. Student ability to work together		
14. Student ability to relate to others and respect each other's individual contributions to the group project		
15. Student ability to self - evaluate their own work		
16. Positive student attitude toward lifelong learning		

Using the following code, please rate each:

LOW 1	BELOW AVERAGE 2	AVERAGE 3	ABOVE AVERAGE 4	HIGH 5

CLASSROOM MANAGEMENT	BEFORE PALMS	AFTER PALMS
17. The teacher's ability to meet the individual learning needs of every student to develop to their fullest potential		
18. Actual teaching time		
19. Time to remediate individual student's special learning disabilities		
20. Time to remediate students who just need extra help with certain concepts, tasks, or skills		
21. Teacher planning time		
22. Time to organize and assemble teaching materials		
23. Classroom use of manipulatives		
24. Classroom use of textbooks		
25. Classroom use of technology		
26. Classroom use of trade books		
27. Classroom use of reference resources		
28. Classroom use of office supplies		
29. Classroom use of art, craft, and science materials		

Using the following code, please rate each:

LOW 1	BELOW AVERAGE 2	AVERAGE 3	ABOVE AVERAGE 4	HIGH 5

SCHOOL CULTURE	BEFORE PALMS	AFTER PALMS
30. Teacher's stress level		
31. Pleasant, enjoyable, positive classroom environment		
32. Staff morale		
33. Student morale		

Using the following code, please rate each:

LOW 1	BELOW AVERAGE 2	AVERAGE 3	ABOVE AVERAGE 4	HIGH 5

CONCLUDING REMARKS	BEFORE PALMS	AFTER PALMS
34. Student's ability to develop to their fullest learning potential		
35. Effectiveness of teaching techniques in an inclusive classroom		

Table 1

Background Characteristics of Teacher Participants

	%	X	SD	N
Gender				61
Female	91.8			56
Male	8.2			5
Ethnicity				49
Caucasian	93.9			46
Hispanic	2.0			1
Black	2.0			1
Other	2.0			1
Degree				61
BS/BA	66.6			40
MS/MA	34.4			21
Current Position				62
Teacher	90.3			56
Permanent Substitute Teacher	4.8			3
Special Education Teacher	3.2			2
Title I Teacher	1.6			1
School level				60
Elementary	85.0			51
Junior High	10.0			6
High School	5.0			3
Type of Class				61
Regular Education	65.6			40
Inclusion	18.0			11
Special Education	9.8			6
Bilingual Education	4.9			3
Teachers who service all types of classrooms: Regular Education / Special Education / Inclusion / Bilingual Education	1.6			1
Age		47.78	8.91	50
Number of Years in Education Profession		21.61	10.05	61
Number of Years in Various Educational Positions				
Title I		21.50	2.12	2
Regular Education		19.62	11.77	47
Special Education		16.92	7.45	13
Bilingual Education		14.50	10.21	4
Inclusion		4.84	5.95	19
Average Class Size		19.29	4.59	55
Grade Level		3.67	2.67	52

Table 2

Percent Utilization of PALMS by Subject Area

	Weekly Utilization of PALMS		
Subjects	X	SD	N
Science	28.07	29.19	57
Math	25.62	26.37	56
Integrated Across the Curriculum	19.82	29.76	56
Reading	14.59	24.08	56
Social Studies	13.88	22.73	58

Table 3

ANOVAs for Number of Years of Teaching by Use of PALMS in the Integrated Curriculum

	Integrated Across the Curriculum Utilization Percent				
Years in Teaching	N	X	SD	F	p
1 - 10 Years in Teaching	12	10.42	15.44	6.02	.001
11 - 20 Years in Teaching	11	49.09	46.57		
21 - 30 Years in Teaching	22	17.73	21.97		
31 - 40 Years in Teaching	10	5.50	11.65		

Table 4

Paired Samples T - Tests for Student Growth

	BEFORE			AFTER			
	N	$\bar{X}$	SD	$\bar{X}$	SD	t	p
Student Time on Task	51	2.71	.73	3.88	.74	10.95	.001 ***
Student Interest	52	2.79	.72	4.38	.63	15.96	.001 ***
Student Motivation	52	2.77	.73	4.21	.64	14.34	.001 ***
Student Self-Esteem	52	2.69	.70	3.87	.71	4.38	.001 ***
Student Learning	52	2.85	.72	3.87	.74	9.43	.001 ***
Student Participation	52	2.85	.67	4.33	.79	14.17	.001 ***
Student Verbal Communication	52	2.69	.81	3.71	.87	10.10	.001 ***
Student Written Responses to Essay	49	2.41	.89	3.24	1.01	6.07	.001 ***
Student Problem-Solving Ability	52	2.37	.86	3.50	.94	10.66	.001 ***
Student Utilization of Higher Level Critical Thinking Skills	52	2.37	.84	3.48	.90	9.67	.001 ***
Student Test Scores	46	2.57	.72	3.22	.79	6.91	.001 ***
Student Appropriate Behavior	51	2.71	.73	3.39	1.00	4.67	.001 ***
Student Ability to Work Together	50	2.58	.78	3.64	1.14	7.09	.001 ***
Student Ability to Relate to Others and Respect Each Other's Individual Contributions to the Group's Project	50	2.60	.70	3.64	.85	9.11	.001 ***
Student Ability to Self-Evaluate Their Own Work	52	2.46	.70	3.37	.91	8.42	.001 ***
Positive Student Attitude Toward Lifelong Learning	50	2.60	.70	3.46	.84	8.69	.001 ***

Note *** $p \leq .001$.

Table 5

Paired Samples T - Tests for Classroom Management and Teaching Resources

	BEFORE			AFTER			
	N	X	SD	X	SD	t	p
The Teacher's Ability to Meet the Individual Learning Needs of Every Student to Develop to Their Fullest Potential	51	3.00	.77	3.63	.96	6.22	.001 ***
Actual Teaching Time	49	3.18	.88	3.76	.90	4.50	.001 ***
Time to Remediate Individual Student's Special Learning Disabilities	49	2.73	.70	3.33	.99	5.09	.001 ***
Time to Remediate Students Who Just Need Extra Help With Certain Concepts, Tasks, or Skills	48	2.81	.61	3.54	.94	5.51	.001 ***
Teacher Planning Time	49	2.65	.80	3.33	1.38	4.41	.001 ***
Time to Organize and Assemble Teaching Materials	48	2.54	.77	3.33	1.34	5.43	.001 ***
Use of Manipulatives	51	2.67	.79	4.08	.84	10.47	.001 ***
Use of Textbooks	50	3.12	.77	2.80	1.01	-1.88	.066
Use of Technology	50	2.74	.66	3.54	.93	6.11	.001 ***
Use of Trade Books	49	2.71	.74	3.55	.98	6.21	.001 ***
Use of Reference Resources	50	2.86	.83	3.64	.92	6.57	.001 ***
Use of Office Supplies	47	2.87	.54	3.32	1.02	3.22	.002 **
Use of Art, Craft, and Science Materials	50	2.96	.64	4.08	.80	8.84	.001***

Note. ** $p \leq .01$; *** $p \leq .001$ Significant differences were not found for Use of Textbooks

Table 6

Paired Samples T - Tests for Classroom Culture, School Culture, and Concluding Remarks

	BEFORE			AFTER			
	N	X	SD	X	SD	t	p
Teacher's Stress Level	49	3.20	.71	3.53	.94	2.27	.028 *
Pleasant, Enjoyable, Positive Classroom Environment	49	3.20	.68	3.61	.95	3.14	.003 **
Staff Morale	44	2.84	.57	3.25	.89	3.74	.001 ***
Student Morale	49	3.00	.58	3.80	.87	6.62	.001 ***
Students' Ability to Develop to Their Fullest Learning Potential	51	2.80	.60	3.80	.63	9.90	.001 ***
Effectiveness of Teaching Techniques in an Inclusive Classroom	46	2.83	.49	3.80	.69	9.29	.001 ***

Note. * $p \leq .05$, ** $p \leq .01$, *** $p \leq .001$

Table 7

ANOVAS for School Level by Perceived Change in Classroom Teaching and Learning Components

		Difference in Teaching and Learning Component Scores After PALMS Use Minus Before			
School Level	N	X	SD	F	p
Elementary	45	28.80	13.87	4.12	.023
Junior High	2	36.50	12.02		
High School	3	6.67	9.07		

Note. The differences, after minus before, were summed

Table 8

ANOVAS for Class Type by Perceived Change in Classroom Teaching and Learning Components

		Difference in Teaching and Learning Component Scores After PALMS Use Minus Before			
Class Type	N	X	SD	F	p
Regular Ed.	35	27.00	14.51	2.40	.079
Special Ed.	4	27.25	7.63		
Inclusion	9	26.11	16.15		
Bilingual Ed.	3	49.67	10.02		

Note. The differences, after minus before, were summed.

Table 9

ANOVAS for Years in Teaching by Perceived Change in Classroom Teaching and Learning Components

		Difference in Teaching and Learning Component Scores After PALMS Use Minus Before			
Years Teaching	N	X	SD	F	p
0-10	11	27.18	21.61	1.78	.165
11-20	8	37.63	12.43		
21-30	22	29.05	11.09		
31-40	10	21.70	14.34		

Note. The differences, after minus before, were summed.

Table 10

ANOVAS for Age by Perceived Change in Classroom Teaching and Learning Components

		Difference in Teaching and Learning Component Scores After PALMS Use Minus Before			
Teacher's Age	N	X	SD	F	p
28-40	8	34.13	19.29	.67	.517
41-49	14	28.36	18.40		
51-65	20	26.40	12.42		

Note. The differences, after minus before, were summed

Table 11

Changes in Teaching Resulting from Utilizing PALMS

	# of Responses
Improved Teaching Practices / Reflective Teaching	23
Approach Good for Students	18
Changed Teaching Methods	13
No Change / Remained the Same	5
Increased Stress	3
Increased Preparation Time / Teaching / Remediation Time	2
Increased Use of Teaching Materials	1

Note. N = 65

Table 12

Rating of the PALMS Approach

	X	SD	N
Overall Effectiveness of PALMS Approach	3.92	.71	48
How Students Like PALMS Approach	4.20	.82	49

Note. A 1-5 scale was used to rate each response where 1 = lowest and 5 = highest.

Table 13

Correlations of Effectiveness Rating of PALMS with Percent Utilization in Subject Matter Areas

	Overall Effectiveness Rating of PALMS Approach		
% Utilization in	n	r	p
Integrated Across the Curriculum	44	.31	.05 *
Science	45	.30	.05 *
Math	44	.30	.05 *
Social Studies	46	.15	.32
Reading	45	.14	.35

Note. *Correlations between percent utilization overall effective rating of the PALMS approach is significant at the .05 level for the integrated across the curriculum approach, science and math

Table 14

ANOVAs for Effectiveness Rating of PALMS Approach by Level Taught

	Effectiveness of PALMS Approach				
Teaching Level	N	X	SD	F	p
Elementary	41	3.85	.65	6.70	.003
Junior High	3	5.00	.00		
High School	2	3.00	.00		

Table 15

ANOVAs for Effectiveness Rating of PALMS Approach by Type of Class

	Effectiveness of PALMS Approach				
Type of Class	N	X	SD	F	p
Regular Education	32	3.88	.7	.67	.62
Special Education	4	3.75	.96		
Inclusion	7	4.00	.82		
Bilingual Education	3	4.00	.00		
Regular / Special Education/ Inclusion /Bilingual	1	5.00	.00		

Table 16

ANOVAs for How Students Like PALMS Approach by Level Taught

	Students Like Using PALMS Approach				
Level Taught	N	X	SD	F	p
Elementary	41	4.24	.66	.89	.42
Junior High	4	4.00	2.00		
High School	2	3.50	.71		

Table 17

ANOVAs for How Students Like PALMS Approach by Type of Class

	Students Like Using PALMS Approach				
Type of Class	N	X	SD	F	p
Regular Education	33	4.18	.92	.41	.81
Special Education	4	4.50	.58		
Inclusion	7	4.14	.69		
Bilingual Education	3	4.00	.00		
Regular / Special Education / Inclusion / Bilingual	1	5.00	.00		